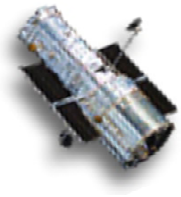
Hubble Facts



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Servicing Mission 4 Manifest

With more than 13 years of historically astounding science already accomplished, Hubble looks to the next servicing mission to enhance its capabilities for even more exciting new discoveries. Servicing Mission 4 will: 1) greatly enhance the scientific capability of HST, 2) enhance the observatory subsystems that support scientific capabilities, and 3) replace failed or limited life subsystem components. The figure illustrates the planned mission timeline.

Enhance Scientific Capability

Cosmic Origins Spectrograph: The Cosmic Origins Spectrograph will be the most sensitive ultraviolet instrument flown on HST. With its high-throughput optical design, its Far Ultraviolet channel will provide a factor of 10-20 times improvement over previous instruments in sensitivity for medium to high resolution ultraviolet spectroscopy. The Near Ultraviolet channel is 2-4 times more sensitive than the Space Telescope Imaging Spectrograph at a single wavelength. The Cosmic Origins Spectrograph will restore redundancy to HST's ultraviolet spectroscopy capability where presently the Space Telescope Imaging Spectrograph is a single string instrument as a result of a previous electronics part failure.

Wide Field Camera 3: The Wide Field Camera 3 (WFC3) will be the first panchromatic instrument on HST, providing a wide field and wide spectral range imaging capability. The two channels cover from near ultraviolet to near infrared. The near ultraviolet detector will provide a 40 times improvement in imaging discovery efficiency. The near infrared detector will provide a 10 times improvement in survey speed, with better angular resolution and greatly improved photometric accuracy. In the visible region, the Wide Field Camera 3 restores performance lost in other HST instruments due to radiation damage to the CCD detectors.

Enhance Observatory Subsystems

Aft Shroud Cooling System: The aft shroud cooling system provides the capability to transport heat from the HST Aft Shroud Section and reject the heat to space by use of a radiator mounted externally on the Aft Shroud. The Aft Shroud temperature has steadily increased over the life of the mission, mostly due to added power dissipation of new equipment and partly due to multi-layer insulation degradation. The Aft Shroud Cooling System will benefit science efficiency by enabling lower operating temperatures of the instrument detectors, thereby reducing detector background noise, improving charge-transfer efficiency, reducing hot pixel generation, etc. In addition, the Aft Shroud Cooling System will allow for increased science efficiency by providing more flexibility in the parallel use of instruments.

Data Management Unit to Scientific Instrument Command and Data Handling Cross Strap Unit: The Data Management Unit to Science Instrument Command and Data Handling Cross Strap Unit (DSC) adds redundancy to the spacecraft interface with the science instrument control and data handling section. This will provide added levels of protection against hardware failures in order to sustain the command data, engineering data, and science data paths to the instruments.

Replace Subsystem Components

Rate Sensor Units: The Rate Sensor Units allow the Telescope to point at stars, planets, and other celestial targets. Three are aboard Hubble, and each unit contains two gyroscopes. Hubble needs three of these six gyroscopes to meets its very precise pointing requirements, and the other three are spare. Gyroscopes have limited lifetimes, and currently four of the six are working, one more than the minimum needed to continue science operations. Current reliability projections show that the probability of having three or more operating gyroscopes will be less than 50 percent by the December 2005 timeframe. In Servicing Mission 4, Astronauts will replace all three Rate Sensor Units, leaving Hubble with six fresh gyroscopes. Rate Sensor Units have been enhanced for Servicing Mission 4 with the addition of silver coated flex leads designed to extend gyroscope lifetime. This new set of gyroscopes could carry Hubble science operations beyond the planned end of mission in 2010.

Battery Modules: The six batteries currently on board the observatory are all original equipment. After over 13 years of continuous operation the batteries are degrading, as expected. In the current condition, the Hubble electrical power system requires careful management of system state of charge to assure adequate power margins for all operational scenarios. This will become more difficult, and will start to constrain operations, e.g., limit the operational usage of instruments. In addition, battery cell lifetime is a major concern. Sudden failures may occur that will substantially reduce total system capacity. The changeout of the two HST battery modules (each containing three batteries) will rejuvenate the electrical power system. This combined with the electrical power system enhancements made in Servicing Mission 3B, will result in ample power margins for the remainder of HST's lifetime.

Fine Guidance Sensor: This is the third in a "round-robin" series of changeouts and refurbishments of the three fine guidance sensors, which allow fine pointing for science observing. The Servicing Mission 4 refurbished Fine Guidance Sensor is the same unit that was returned from Servicing Mission 3A. The Fine Guidance Sensor to be replaced is an original unit that has been operational since the beginning of the mission in April 1990. The unit is showing an increasing trend in wear-out of the star selector bearings. Left untended, this continuing trend will lead to acquisition failures and missed science-observing opportunities.

New Outer Blanket Layer: Stainless steel sheets will be installed on the exterior of the HST to provide additional thermal protection to the equipment bays, replacing the existing multi-layer insulation which has slowly degraded over time with exposure to the harsh environment of space. Covered with a protective thermal coating, these sheets will fit directly onto the existing equipment bay doors. On Servicing Mission 4, New Outer Blanket Layer panels will be installed on equipment bays 5, 7, and 8. The New Outer Blanket Layer panels will assure

thermal protection of the equipment, e.g.,
safemode computer in bay 8.